

### **REMARKS/ARGUMENTS**

In the Final Office Action mailed August 21, 2007, Claims 1, 5, 8-11, 13-14, 19-22 and 24 were rejected under 35 U.S.C. 103(a) over U.S. Patent No. 6, 218,268 to *Xia*. Claims 2, 3, 6, and 7 were rejected under 35 U.S.C. 103(a) over *Xia* in view of U.S. Patent No. 6,013,584 to *M'Saad*. Claims 4, 12 and 23 were rejected under U.S.C. 103(a) over *Xia* in view of U.S. Patent Publication No. 2002/0050605 to *Jeng*. And lastly, Claims 15-18 and 25-28 were rejected under 35 U.S.C. 103(a) over *Xia* in view of U.S. Patent No. 6,500,771 to *Vassilev*. Reconsideration and withdrawal of these rejections is respectfully requested in view of the following remarks.

#### **A. *Xia* Does Not Describe or Suggest A Continuous Change In A Ratio of Deposition Precursors Between the Beginning and End of a Film Layer Deposition**

The rejection of Claims 1, 5, 8-11, 13-14, 19-22 and 24 under § 103(a) over *Xia* is respectfully traversed because this reference neither describes nor suggests varying, between the beginning and end of the deposition of a conformal layer, a ratio of two precursors used to deposit the layer. This element is described in all four independent claims: Claim 1 describes “varying between a beginning and end of the depositing of the conformal layer a ratio of the (silicon-containing processing gas plus phosphorous-containing processing gas):(oxidizing processing gas).” Claim 5 recites “varying between a beginning and end of the depositing of the conformal layer a ratio of the (silicon-containing processing gas):(oxidizing processing gas).” Claim 8 notes “varying over time a ratio of the (silicon-containing gas):(oxidizing gas) flowed into the chamber.” Finally, Claim 19 states “varying over time a ratio of the (silicon-containing gas):(oxidizing gas):(phosphorous-containing gas) flowed into the chamber.”

The present Office Action concedes that *Xia* does not describe varying the ratio of deposition precursors between the beginning and end of a deposition:

“*Xia et al.* does not explicitly include varying the ratios of gases between the beginning and end of the depositing of the conformal layer.”

(Office Action, p. 3, ll. 17-18).

However, the Office asserts that *Xia* suggests this element because the reference describes a two-layer deposition as improving gap filling, thickness uniformity, and film stability over a one-layer film. The Office argues that one of skill in the art reading this would “find it within their known options to use a graded dopant concentration to receive the above benefits,

knowing that if two layers with two dopant concentrations improved over one layer it follows that one would want a layer made up of many dopant concentrations to improve over two dopant concentrations.” (Office Action, p. 4, 17-21). On the contrary, one of skill in the art reading the entire reference would, if anything, find that it teaches away from using a graded dopant concentration.

*Xia* expressly notes that depositing a two-layer BPSG film with different deposition conditions between the layers is not simply a matter of changing the conditions. There were particular problems maintaining the relative phosphorous dopant concentration as the TEOS flow rate was changed. If the relative concentrations are not carefully controlled, a dopant deficient layer can form that reduces re-flow and the ability to fill voids:

It was discovered that depositing a two-layer BPSG film at different deposition conditions is not a matter of simply changing the conditions. A smooth transition between the first deposition conditions and the second deposition conditions is important to ensure a film with the desired properties, and especially to maintain the re-flow characteristics of the film. The re-flow characteristics of a BPSG layer depend on the dopant concentration, a higher dopant concentration typically resulting in better re-flow characteristics, such as a lower melting point and greater fluidity. A particular problem arose in maintaining the relative phosphorous dopant concentration as the TEOS flow rate was changed.

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[A] dopant deficient layer in the middle of the BPSG layer reduces re-flow, and hence the ability to fill voids.

(*Xia*, col. 13, l. 59 to col. 14, l. 15.)

If anything, this description teaches away from continuously varying precursor flow rates because it would be difficult to control the dopant concentration, increasing the chances of forming a dopant deficient layer. Thus, *Xia* does not suggest to one of skill in the art to use a continuously graded dopant concentration during the deposition of a conformal layer. For at least this reason Claims 1, 5, 8, and 19 (and their dependent claims) are allowable over *Xia* and withdrawal of the rejection of Claims 1, 5, 8-11, 13-14, 19-22 and 24 under § 103(a) over the reference is respectfully requested.

The remaining rejections over *Xia* in view of the secondary references to *M'Saad*, *Jeng*, and *Vassilev* are traversed for the same reason, because none of these references remedies the deficiency with *Xia*. Thus, withdrawal of the rejections of Claims 2, 3, 6, and 7 under §

103(a) over *Xia* and *M'Saad*, Claims 4, 12 and 23 over *Xia* and *Jeng*, and Claims 15-18 and 25-28 over *Xia* and *Vassilev* is also respectfully requested.

**CONCLUSION**

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 303-571-4000.

Respectfully submitted,

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